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Sonya K. Huffman
Iowa State University, skostova@iastate.edu

Helen H. Jensen
Iowa State University, hhjensen@iastate.edu

Abebayehu Tegene
United States Department of Agriculture

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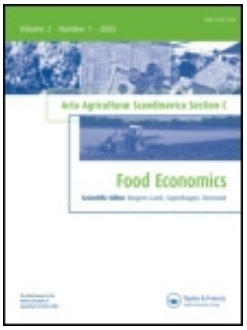

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ORIGINAL ARTICLE

Consumer demand for cholesterol-lowering enhanced margarine products

SONYA KOSTOVA HUFFMAN[1], HELEN H. JENSEN[1] & ABEBAYEHU TEGENE[2]

[1]*Department of Economics, Iowa State University, Ames, IA, USA, and* [2]*Economic Research Service, US Department of Agriculture, Washington, D.C., USA*

Abstract
The development and introduction of nutritionally enhanced margarines in the mid-1990s offered the opportunity to improve public health through the use of a cholesterol-lowering food product. Product approval in the USA followed that in Europe. The public approval and market acceptance of the nutritionally enhanced product illustrate the challenges faced by offering improved health attributes through food product innovation. Although the product Benecol received public endorsement and was relatively quickly accepted by Finnish consumers, public acceptance has been slower in the USA. Our study traces consumer response to the introduction of nutritionally enhanced margarine products in the US market. Household scanner data allow estimation of hedonic price functions and a probit model on the choice of the health-promoting product attribute. US consumers of the enhanced margarine products place a relatively high value on the cholesterol-lowering attribute, although a relatively small share of households purchase the products that include it.

Keywords: *cholesterol, demand for healthy food, functional food.*

New production and processing methods have led to significant changes in foods in response to consumer preferences for health-promoting attributes in foods and scientific advancements. Improved knowledge about inherent attributes in foods as well as technical enhancement of foods through changes in food composition offer consumers the choice over products that can promote health (Singletary & Morganosky, 2004). However, because most countries tightly regulate the safety and quality of food products, public food and health policies shape the availability and access to the enhanced products. Ultimately, the availability and access to the enhanced food products reflect both the market test as well as policies in place.

The introduction of cholesterol-lowering margarine and spread products in the 1990s provides an example of a nutritionally enhanced functional food that has faced different public review and market acceptance in Europe and the USA. The new products, Benecol and Take Control margarines, are functional food products which help to lower blood cholesterol levels. Benecol products include plant stanol esters, an ingredient derived from pine trees; Take Control contains naturally occurring unsaturated sterols, primarily sitosterol from soybean oil. Plant sterols and stanol esters have been shown to lower serum low-density lipoprotein (LDL) cholesterol and therefore may reduce the risk of cardiovascular disease (de Jong et al., 2003; Hyun et al., 2005). Coronary heart disease (CHD), one of the most common and serious forms of cardiovascular disease, is a leading health problem in Finland and causes more deaths in the USA than any other disease (Food and Drug Administration [FDA], 2000). High total cholesterol levels and high levels of LDL cholesterol are risk factors for CHD.

Review of the introduction of cholesterol-lowering margarines highlights the role of public policies in shaping the market for foods with enhanced nutritional characteristics. At the same time, marketing, acceptability, and appeal to consumers are essential to establishing the market place value and success of the products. In this paper, we examine the market place introduction and acceptance of health-

Correspondence: Helen H. Jensen, Deparment of Economics, Iowa State University, 578 Heady Hall, Ames, IA 50011-1070, USA. Tel: +515 294 6253. Fax: +515 294 6336. E-mail: hhjensen@iastate.edu

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promoting foods (cholesterol-lowering spreads) in the USA. We model the consumer food choices based on economic, ethnic, and other socioeconomic characteristics with respect to enhanced/functional margarine products that contain plant sterol or plant stanol esters to reduce the risk of CHD (Benecol and Take Control margarines) and conduct empirical analysis of household panel scanner data to evaluate factors that influence consumer choice and valuation of the health-promoting attribute.

Product development

Benecol was developed and introduced in Finland by food company Raisio in 1995 in response to a major public health initiative to lower the country's cholesterol levels and risk of cardiovascular disease (Benecol†, 2007). It has been marketed primarily as a functional food that possesses characteristics that achieve or maintain good health in addition to other basic nutrition. At its market peak, Benecol captured 40% of the Finnish market for margarines (Dunn, 2005). However, by 2000, its growth in sales in Finland had slowed. Despite the slowdown in sales growth, today Benecol† branded products are sold to millions of consumers in more than 20 countries worldwide, but mostly in Europe. In Europe, the manufacturers were able to avoid review under the European Union's new regulations and novel food committees, requirements put into effect in 2000, because the product had been on the market in Finland since 1995 and thus exempt from the regulation.

Once developed and on the market in Finland, McNeil, the manufacturer of Benecol, and Unilever, the manufacturer of the competing product Take Control, prepared to introduce the two products in the US market. However, the approval process turned out to be complex (Heller et al., 1999). In the USA, the US FDA has authority to evaluate and determine the safety of food products and product ingredients, as well as dietary supplements. Initially, McNeil argued that Benecol was a dietary supplement; FDA insisted it was a food that included a new ingredient. As a food, FDA reviews three types of claims: health claims (the most rigorous review and supported by strong, scientific evidence); structure/function claims (that the substance has an effect, but no claim of affecting disease outcomes); and Generally Recognized as Safe (GRAS, the least stringent criterion). Eventually, both McNeil Consumer Health Care, a subsidiary of Johnson & Johnson marketing Benecol, and Lipton, a subsidiary of Unilever marketing Take Control, applied and received approval for the active ingredients as GRAS and thus exempt from lengthy FDA review. The products could be marketed on the basis of their cholesterol-reducing ingredients.

In May 1999, the FDA approved the sale of Take Control and Benecol margarines in the USA and the manufacturers were allowed to claim that their products included components that block the absorption or re-absorption of cholesterol. Later research supported the health benefits and in September 2000, the FDA ruled that the manufacturers of foods containing plant stanol and sterol esters could state that the products reduced the risk of heart disease, and thus make a health claim (FDA, 2000). Product sales in the first full year in the market (1999 to August 2000) reached a level of US$54 million; the combined marketing campaigns in 1999 alone cost US$64 million (Farris et al., 2008). Initially, the products were marketed to consumers with heavy product promotion and use of coupons.

Consumer acceptance and preference for health-promoting ingredient

There is some market evidence on factors that affect consumer choice and valuation of functional foods and functional attributes. Themes identified in consumer studies indicate that consumers of functional foods (1) are oriented to health and health-promoting aspects; (2) are more likely to accept functional ingredients that have broad application or are more easily understood (e.g. calcium enhancement vs. unknown compounds such as xylitol); and (3) value functional foods as foods first, and may not value an aspect that provides off-flavor or where there is not a natural match to the product (Bech-Larsen & Scholderer, 2007). Consumers' trust in the efficacy of the products as well as the credibility of product manufacturers and retailers are also important to the success of the product (Veeman, 2002). An experimental study in Canada indicates that although Canadian consumers identify that food choices may be associated with the likelihood of suffering diseases, the associations vary by type of disease (e.g. heart risk compared with cancer risk), type of food, technology used (genetic modification or not), and demographics (West et al., 2002). The Canadian consumers were willing to pay a premium for health-promoting attributes in the state-choice experiments.

In both Finland and the USA, the cholesterol-lowering margarine products were introduced and marketed with heavy promotion. Benecol was sold in Finland at a cost about 4–6 times that of regular margarine. The product was promoted heavily for its cholesterol-reducing qualities, good taste, and emphasis on scientific evidence supporting the claims of health-promoting qualities. In addition to private marketing campaigns, the Finnish Society for Internal

Medicine recommended plant stanol ester margarine use in its program for preventing cardiovascular disease (Anttolainen et al., 2001).

Finnish consumers associate foods with positive values. A recent study of Finnish consumers shows Finnish consumers to be familiar with functional foods and more willing than consumers in other countries to accept foods and food technologies as a way to promote good health. Also, Finnish consumers tend to trust food manufacturers, although this may be conditioned on their belief that the public regulatory mechanisms work well (Niva & Mäkelä, 2007). In their study, Niva and Mäkelä find that consumers in middle age groups (45–59-years-old) and with more education were more optimistic about functional foods than were other adults (classified as those 15-years-old and older). Finnish consumers were willing to pay the higher price of the functional foods, although Finnish consumers may be used to higher food prices than consumers in the USA.

After the introduction of Benecol in the Finnish market, a significant share of consumers purchased the new product with estimates as high as 40% of households using the product. Survey evidence indicates that the product gained acceptance as a health-promoting product. The National Public Health Institute in Finland conducts regular surveys of the Finnish population and includes questions on health and lifestyle. Beginning in 1996, a question on use of plant stanol ester margarine was included. In the period 1996–1998, 4.7% of subjects of age 35–84-years-old ($n = 23{,}657$) indicated that they used plant stanol ester margarine as their primary spread (Anttolainen et al., 2001). Among individuals aged 65–74 years, the share was 10%. In comparison to those not using the plant stanol ester margarines, users were better educated, had higher incomes, and were more likely to be married. They also were more likely to live in urban areas. Almost half of the regular users had cardiovascular disease.

To date, there is little evidence on consumer acceptance and willingness to pay for the cholesterol-lowering margarines in the USA, although during the 1990s many US consumers became more aware of the link between dietary fat intake and the increased risk of chronic diseases. Knowledge about the link between fat intake and CHD has been shown to affect consumers' choices of fats, oils, butter, and spreads (for example, Kim & Chern, 1995; Gould, 1997). Thus, the review and introduction of Benecol and Take Control into the US market occurred with increasing attention being paid to the composition of butter, margarines, and spreads. We now turn to examine what occurred in the USA following the introduction of Benecol and Take Control on the national market. Household scanner data provide the evidence on household market purchases and characteristics of consumers willing to purchase the new health-promoting food products. Comparison with the experience in Finland provides some evidence on the role of consumer factors in acceptance of foods with enhanced composition and health-promoting attributes.

US consumer choice for enhanced margarine

In this part, we provide the empirical specification of household's consumption decisions and estimation methods, and description of the data. The approach we follow uses hedonic methods to estimate consumer values for the various attributes of the margarine, butter, and spread products. Data come from the 1999 ACNielsen Homescan Panel Data. Consumer implicit values (i.e. hedonic prices) of attributes are estimated by a regression, which expresses the price of a product as a function of the coefficients associated with each characteristic. These implicit values are then used in a probit model on the choice of margarine characteristics to describe and evaluate the consumer characteristics associated with the product adoption. We are interested particularly in the value (marginal value) that consumers place on the health-promoting, cholesterol-lowering functional attribute included in the margarine.

Empirical specification and estimation

The empirical specification of the hedonic price function is

$$\ln p_s = \sum_{k=1}^{K} h_{sk} A_{sk} + e_s; \qquad (1)$$

where $\ln p_s$ is the price of product s in logarithm, h_{sk} is the price of k attribute in product s, and e_s is the regression residual. This function can be fitted to data on market price and observed characteristics. When the market for attributes is in equilibrium, the hedonic method provides an objective valuation of attributes (National Research Council, 2002).

We use the semilog functional form for the hedonic equation to allow for one or more characteristics being equal to zero, which is important if new characteristics come to the market (Diewert, 2003). The purpose of the hedonic model is to provide predicted prices for each product attribute. In addition to the cholesterol-lowering attribute, contained in both Benecol and Take Control margarines, the Benecol margarine also came in two types: diet spread and 'full' fat spread. The set of characteristics (A_{sk}) examined were identified with indicators (0, 1) if the product was: (a) diet; (b)

butter (including blend); and (c) cholesterol lowering (i.e. the Benecol or Take Control brand).

The household choice for the cholesterol-lowering attribute (obtained through purchase of either the Take Control or Benecol margarines) is expressed as follows. Let the household random indirect utility function be

$$V_{ki} = \mathrm{a}_{ki}\mathbf{X} + \mathrm{o}_{ki}; \quad (2)$$

where $\mathbf{X}$ is a vector of individual (household) characteristics and prices; a_{ki} is the choice-specific parameter vector; and o_{ki} is the unobserved random component. The household i chooses attribute k such that $V_{ki} \square V_{ji}$. The probability of the household's choice of characteristic k, C_{ki}, is

$$\mathrm{Prob}(C_{ki} = 1) = \mathrm{Prob}(V_{ii} \mathrm{B} V_{ki}) = \mathrm{F}(\mathrm{a}_i\mathbf{X}); \quad (3)$$

where $\mathrm{F}(\mathrm{a}_i\mathbf{X})$ is the standard normal distribution (Greene, 2000). Since the coefficients from the probit model are difficult to interpret, we calculate the marginal effects of the variables as

$$\mathrm{ME}_i = \frac{@P(C_{ki} = 1)}{@X_{ki}} = \mathrm{F}^{\circ}(\mathrm{a}_i\mathbf{X})\mathrm{a}_i: \quad (4)$$

We estimate the household consumption using the maximum-likelihood estimator and the econometric software STATA 10. The consumption variable is a limited dependent variable equal to 1 if the household purchased the dairy product characteristic and 0 otherwise.

Data and variables

To estimate our model, we use a subset of the AC Nielsen Homescan Panel Data for 1999, which links data on product purchases and household demographics. The combined panel included 7123 households who reported dairy purchases (including margarine, butter, and spreads) and reported purchases on at least 10 of the 12 months surveyed during the year. The Homescan households are randomly recruited using sampling techniques to ensure household representation for demographic variables, such as household income, location, education, and family composition. The data contain information on purchase date, brand, quantity (packages), price paid deal, price paid non-deal, coupon value, and product attributes for purchases made at retail stores during the survey period. We matched the households with the household purchases. The household characteristics include household size, income, age, education, and employment of female and male head, marital status, race, and region of residence.

For detailed information on the Homescan data see Muth et al. (2007) and Einav et al. (2008). Although the data are reported on all days of 1999, we used aggregated purchases at the monthly level, only for the period May–December, the period when the two margarine products were available on the market.

In comparison to national data, the households in our sample had higher income (US$52,423 compared to US$41,994), similar household size, were more likely to be married, and had a relatively larger share of white race (84.7% compared to 75.1%) households (U.S. Census Bureau, 2000). The unit value was calculated to estimate the model in Equation (1) for the commodity (dairy product) groups of interest. It was calculated as follows: household expenditure per month on the dairy products (butter, margarine, and spread) in dollars was divided by household quantity in pounds purchased per month. The individual expenditure for each purchased occasion was calculated net of any promotion or coupon.[1] We excluded from our sample households who did not have any dairy purchases for two consecutive months. The total number of households in our sample is 6607.

For the purposes of our analysis, the products are classified as "regular" (which includes lactose free) and "diet" (which includes diet, light, low fat, reduced fat, fat free, and non-fat). The reduced or lower fat varieties include less than 60% of the fat in regular types and diet or reduced calorie margarines may contain a large amount of water (55–60%). The lower calorie level is due to lower fat content and higher water content (Zavadil, 1989) All these products are grouped as diet.

Table I. Number of households that purchased a particular dairy product (standard deviations are in parentheses).

Product category	Number of households	Percentage of households (%)	Average monthly quantity (pounds)	Average monthly expenditure (US$)	Average unit value (US$/lb)
Total dairy	6607	100.0	2.32 (2.31)	3.03 (3.35)	1.23 (1.21)
Butter, margarine, and spread	6486	98.2	2.74 (2.28)	3.57 (3.36)	1.51 (1.17)
Butter	4056	61.4	1.89 (1.64)	4.70 (3.89)	2.65 (1.02)
Margarine and spread	5820	88.1	2.63 (2.17)	2.38 (1.99)	1.05 (0.99)
Margarine	2486	37.6	1.94 (1.63)	1.79 (1.56)	0.96 (0.46)
Spread	5533	83.7	2.55 (2.12)	2.29 (1.92)	1.07 (1.11)
Blends	65	1.0	1.23 (0.51)	1.92 (0.99)	1.59 (0.59)
Regular margarine and spread	5626	85.2	2.57 (2.15)	2.27 (1.92)	1.02 (0.93)
Diet margarine and spread	2274	34.4	1.89 (1.49)	1.93 (1.57)	1.28 (1.69)
Benecol and Take Control	477	7.2	0.65 (0.40)	4.52 (3.40)	7.55 (4.34)

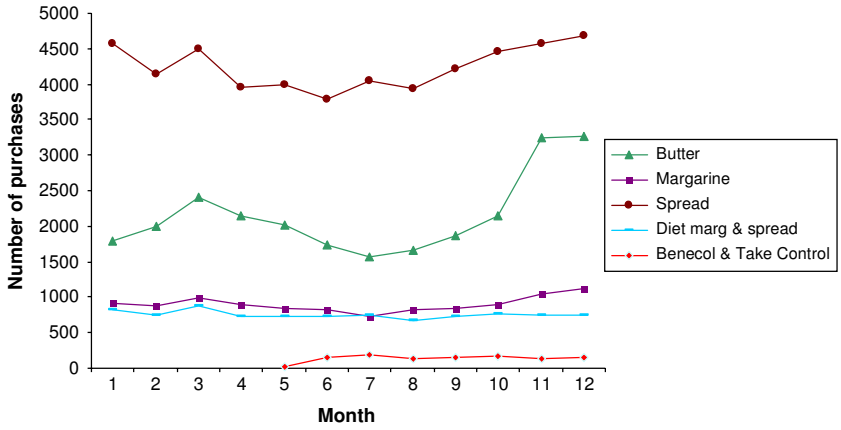

Figure 1. Number of purchases by categories per month, 1999.

Table I presents the number of households who purchase the different dairy groups, the average monthly quantity purchased, the average monthly expenditure (of those purchasing the product), the average unit value paid for the product, and the statistical information concerning the standard deviations of the means. There are 6607 households (or sample) that purchased dairy products during the 1999. Most (98%) households consumed one of the dairy spread products. Of the sample, 61% of the households purchased butter and 34% purchased some diet margarine or spread. Figure 1 presents the number of purchases by month for the different dairy groups.

The products of particular interest in this study are Benecol and Take Control; 7.2% of the households purchased these products at some point after introduction during the month of May 1999. Given the information available in the ACNielsen panel, the prices are approximated by the unit values. The product unit value is computed as the ratio of the household monthly expenditure on butter, margarine, and spreads (in dollars) and the household monthly quantity purchased (in pounds). For all dairy products, the average expenditure per month was US$3.03 with an average unit value of US$1.23 per pound. For Benecol and Take Control, the average monthly expenditure by consuming households was US$4.52, with an average unit value of US$7.55 per pound. Over 70% of butter purchasers also purchased special, light, or diet spreads and 58% of the margarine purchasers purchased butter (data based on analysis not shown in Table 1).

The household survey data show that after introduction in May 1999, households entered the market and purchases of Benecol and Take Control increased in response to the new offering and heavy product promotion (see Figure 2). The largest number of purchases of Benecol was in June and July of 1999 just after the product was introduced in the market and promoted through the use of coupons. The purchases of Take Control increased gradually after that product was introduced in 1999 and reached its peak in December 1999.

Based on the available data, purchase and household variables were defined and developed, as shown in Table II. The means of the variables for the whole sample, for the households that purchased only butter, only margarine and spreads, and only diet products are presented in Table III. For the full

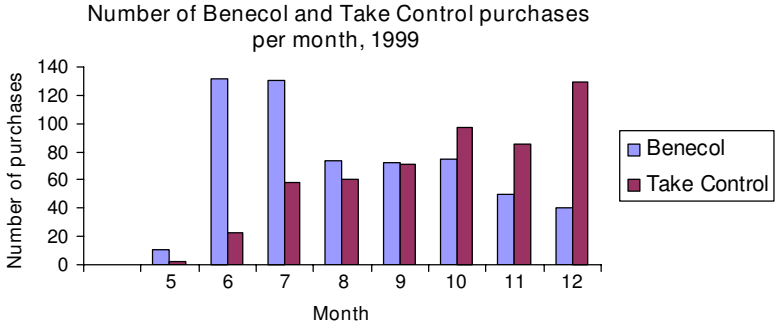

Figure 2. Number of Benecol and Take Control purchases per month, 1999.

Table II. Definitions of the variables in the model.

Variable	Definition
Nhhlds	Number of households
Hhinc	Household income
Hhsize	Household size
Binary variables (1, following conditions met; 0, otherwise)	
Agef30	Female head's age is under 30
Agef50	Female head's age is between 30 and 49
Agef64	Female head's age is between 50 and 64
Agef65	Female head's age is 65 and older
Nofemage	No female head is present
Agem30	Male head's age is under 30
Agem50	Male head's age is between 30 and 49
Agem64	Male head's age is between 50 and 64
Agem65	Male head's age is 65 and older
Nomalage	No male head is present
Kids	Family has children
Emplm	Male head is employed
Emplf	Female head is employed
Edmhs	Male head's education is high school or less
Edmscol	Male head's education is some college
Edmcolpc	Male head's education is college and post college
Edfhs	Female head's education is high school or less
Edfscol	Female head's education is some college
Edfcolpc	Female head's education is college and post college
Married	Family is married
Retiredm	Male head is retired
Retiredf	Female head is retired
White[a]	Race is white
Black[a]	Race is black
Other[a]	Race is other
Hispanic[a]	Family is Hispanic
t6	Month is June
t7	Month is July
t8	Month is August
t9	Month is September
t10	Month is October
t11	Month is November
t12	Month is December
East	Family lives in the east region
Central	Family lives in the central region
South	Family lives in the south region
West	Family lives in the west region
Urban	Family lives in urban area

[a]Households were asked to identify their race/ethnicity. We used those responses to classify households into four broad categories.

sample, the average household income was US$52,423. The highest average income was for the households who purchased only diet products (US$59,188). The average household size for the sample is 2.6 and 31% of the sampled household included children.

Results

First, we estimated the hedonic equation in (1). The dependent variable is the unit value of butter, margarine, and spreads products. Since Benecol and Take Control were introduced in the market during the month of May, we use monthly data from June through December 1999 for the estimation. The results for the pooled sample are presented in Table IV.

The market purchase data show that the cholesterol-lowering attribute in Benecol and Take Control was available to consumers at 134.9% higher value than regular margarine; the value of the diet attribute was 7% higher; and the value of the butter attribute was 77% higher (including regular blend) compared to the regular margarine.[2] In addition to attribute variables, we included in the hedonic equation dummy variables for the four regions and for urban residence. Relative to the west, households in the east region had higher unit values and the central and south had lower unit values for the margarine and spread attributes. Urban areas had higher unit values.

The estimates from the hedonic equation were used to create regional hedonic prices for the attributes for butter taste, diet, and cholesterol-lowering "Benecol/Take Control." The regional hedonic prices were calculated at the means of the variables. These hedonic values or predicted prices for the cholesterol-lowering attribute were used in the estimation of the probability of purchasing the cholesterol-lowering attribute (available in Benecol and Take Control).

With the hedonic values, we estimated the probability of the household consuming Benecol or Take Control as a function of the demographic characteristics of the households, income, the hedonic prices for the attributes and monthly dummy variables, used to account for market promotion and increased product availability. Table V presents the parameter estimates of the probit model for consumption of the health-enhanced product attribute (Benecol/Take Control) in Equation (3) and the marginal effects of the variables computed at the means of the sample (Equation 4). Because the attribute prices are predicted values from the hedonic equation, we used bootstrapping to obtain corrected standard errors.[3]

Most of the demographic household characteristics are statistically significant. Higher household income and adults having college or a post college degree increased the probability of consuming the Benecol/Take Control products which is similar to the Finnish consumers. The coefficients of the education of male or female household head variables indicate that an adult having an education level of high school or of less than a college degree

Table III. Variables and means of the sample (all households), the households that purchased only butter, only margarine and spreads, and only diet products.

Variable	Sample	Only butter	Only margarine and spreads	Only diet
Nhhlds	6607	690	2428	540
Hhinc	52,423	58,650	47,866	59,188
Hhsize	2.60	2.33	2.58	2.30
Agef30 (%)	4.0	3.2	6.2	5.0
Agef50 (%)	43.2	43.6	42.8	41.7
Agef64 (%)	30.8	29.9	28.3	33.3
Agef65 (%)	13.9	9.3	12.8	8.7
Nofemage (%)	8.1	14.1	10.0	11.3
Agem30 (%)	2.5	2.0	3.8	3.3
Agem50 (%)	34.3	35.8	34.5	32.4
Agem64 (%)	27.3	28.4	25.7	25.9
Agem65 (%)	13.3	10.1	12.2	10.9
Nomalage (%)	22.6	23.6	23.8	27.4
Kids (%)	30.8	25.4	31.9	24.3
Emplm (%)	59.4	61.6	58.7	57.6
Emplf (%)	60.8	59.4	60.3	62.6
Edmhs (%)	21.3	14.5	23.7	12.8
Edmscol (%)	23.7	20.4	24.6	19.3
Edmcolpc (%)	32.5	41.4	27.9	40.6
Edfhs (%)	24.5	16.1	27.8	14.8
Edfscol (%)	31.2	26.5	29.1	26.1
Edfcolpc (%)	36.2	43.3	33.1	47.8
Married (%)	65.9	58.6	62.4	58.9
Retiredm (%)	24.2	19.6	24.1	20.0
Retiredf (%)	30.8	26.4	29.7	26.3
White (%)	84.7	85.2	82.0	87.6
Black (%)	9.3	6.2	11.5	4.8
Other (%)	6.0	8.6	6.5	7.6
Hispanic (%)	6.4	5.5	7.4	7.8
East (%)	20.7	33.0	14.7	23.7
Central (%)	25.3	19.1	25.4	21.9
South (%)	34.0	28.0	40.1	34.3
West (%)	20.0	19.9	19.8	20.2
Urban (%)	84.3	89.1	82.6	88.7

Table IV. Estimates of the hedonic equation.

Variable	Estimate
Intercept	−0.082 (0.008)***
Diet	0.071 (0.008)***
Butter (including regular blend)	0.772 (0.006)***
Cholesterol lowering	1.349 (0.017)***
East	0.017 (0.008)**
Central	−0.075 (0.007)***
South	−0.063 (0.007)***
Urban	0.062 (0.007)***
R^2	0.39
Number of observations	40,675

*Statistically significant at the 10% level.
**Statistically significant at the 5% level.
***Statistically significant at the 1% level.
Note: Reference groups were western region and non-urban location; standard errors are in parentheses.

lowered the probability of purchasing the healthy attribute (marginal effects of −0.013 and −0.014 for males, and −0.004 and −0.006 for females, respectively).[4] A household having a head over 50 years old had a positive effect on Benecol/Take Control consumption, a result that is consistent with higher health risk of cardiovascular disease.[5]

The own-price effect for the Benecol/Take Control attribute was negative and statistically significant. The cross-price effects with the butter taste and diet attributes were positive and statistically significant as well and suggest that the diet and butter taste are substitute attributes. A 10% increase in the price of Benecol/Take Control would decrease the probability of consuming the attribute by 1.2%, while a 10% increase in the price of butter would increase the probability of consuming the Benecol/Take Control product attribute by 0.4%. A 10% increase in the hedonic price of the diet attribute

Table V. Estimates from the probit model of consumption of cholesterol-lowering attribute Benecol/Take Control.

Parameter	Coefficient (Standard error)	Marginal effect (Standard error)
Intercept	−3.426 (0.417)***	
Hhincs	0.003 (0.0004)***	0.00034 (0.00005)***
Hhsize	−0.035 (0.012)**	−0.004 (0.001)**
Kids	−0.069 (0.035)**	−0.008 (0.004)**
Married	0.192 (0.050)**	0.021 (0.005)***
White	0.132 (0.051)**	0.014 (0.005)**
Black	−0.061 (0.061)	−0.007 (0.007)
Hispanic	0.116 (0.043)**	0.015 (0.006)**
Agef50	0.560 (0.104)***	0.070 (0.014)***
Agef64	0.870 (0.107)***	0.133 (0.021)***
Agef65	0.922 (0.109)***	0.174 (0.029)***
Nofemage	0.496 (0.121)***	0.079 (0.025)***
Agem50	0.095 (0.123)	0.011 (0.015)
Agem64	0.359 (0.125)***	0.048 (0.019)**
Agem65	0.460 (0.128)***	0.069 (0.024)***
Nomalage	0.291 (0.133)**	0.038 (0.003)**
Emplm	−0.059 (0.031)*	−0.007 (0.004)*
Emplf	−0.084 (0.024)***	−0.0099 (0.003)***
Edmhs	−0.117 (0.029)***	−0.013 (0.003)***
Edmscol	−0.128 (0.026)***	−0.014 (0.003)***
Edfhs	−0.031 (0.027)	−0.004 (0.003)
Edfscol	−0.056 (0.024)**	−0.006 (0.003)**
t7	0.006 (0.034)	0.0007 (0.004)
t8	−0.007 (0.034)	−0.0008 (0.004)
t9	−0.002 (0.034)	−0.0002 (0.004)
t10	−0.001 (0.034)	−0.0001 (0.004)
t11	−0.004 (0.034)	−0.0005 (0.004)
t12	−0.003 (0.034)	−0.0003 (0.004)
Price of Benecol/Take Control	−1.018 (0.223)***	−0.119 (0.026)***
Price of butter	0.371 (0.129)***	0.043 (0.015)***
Price of diet	2.916 (0.727)***	0.340 (0.085)***

*Statistically significant at the 10% level.
**Statistically significant at the 5% level.
***Statistically significant at the 1% level.
Note: The bootstrap standard errors are in parentheses.

would increase the probability of consuming the Benecol/Take Control characteristic by 3.4%. The marginal effects of the price of the Benecol/Take Control (–0.119) and the price of diet (0.34) are larger than most of any other explanatory variables. Thus, the results suggest that consumers are very responsive to changes in the underlying component (hedonic) price of this attribute.[6]

In sum, the estimation established a positive value for nutritional enhancement in consumer choice; we do find consumers substitute between the product attributes for "diet" and the Benecol/Take Control attributes.

Summary and conclusions

The consumer choice of quantity and quality of many products, including improvements in existing goods and the production of new goods, increases every year. There are significant changes in markets as commodity agriculture and food technologists strive to add value to products in response to consumer preferences, enhance food safety, and develop new technologies for producing and manufacturing of foods that meet changes in consumer demand for improved food attributes. Changes in observed food prices reflect changes both in the market for existing foods as well as the added value from new foods (foods with new product attributes).

Both Finland and the USA face large public health costs associated with cardiovascular disease. Although the two countries have had different public policies, and acceptance and attitudes toward food product innovation and functional foods differ, the experience with cholesterol-lowering spreads in both markets indicates some consumer willingness to pay significantly more for the nutrition-enhanced margarine products in both countries. In both countries, the products were heavily promoted. We did not have available information on the expenditures (by month) for advertising, though do capture the discounting available through coupon use on the price. Older adults in both countries, the prime health risk category in the population, are more likely to purchase the products. Our results based on US market data found the value of cholesterol-lowering Benecol/Take Control to be 135% higher than regular margarine. Other determinants for the choice of a healthy margarine characteristic were higher income, education, and age.

Over 7% of US households purchased the cholesterol-lowering margarine product in the first year, though analysis of the household purchases show that most US households consume a mix of products including purchases of both butter and diet spreads. This finding suggests that consumers chose a mix of products to meet their preferences for the attributes in table spreads, and perception of their own health risk. Faced with promotion and advertising, not measured explicitly in our analysis, consumers may not only substitute among products, but also build inventory in the general product category and hence reduce the effect of product switching (van Heerde et al., 2003). Yuan et al. (2009) found that consumers viewed a phytosterol-enriched orange juice product as different from conventional products and they did not reduce consumption of the conventional product (that is, there was little evidence to support "cannibalization" of the functional food product and its conventional brand product). In our case, the attribute for "diet" shows consistently as a substitute for the Benecol/Take Control attribute.

In comparison to the results from the US market for the cholesterol-lowering margarine products where

most households consume a mix of butter and spread products, in Finland, nearly 5% of all individuals of 35 years and older chose the plant stanol ester margarine products as their primary bread spread 2 or 3 years after the product introduction.

Agricultural and food policies can play an important role in shaping food product composition through policies that affect ingredient input use, costs, information provision, and food technologies (Golan & Unnevehr, 2008; Unnevehr & Jagmanaite, 2008). The evidence presented here would indicate that consumers' willingness to accept functional foods and new technologies may differ across countries, but in both countries, consumers are willing to purchase and interested in food products designed to be health promoting. Market evidence indicates that some consumers, though perhaps only a small share, are willing to pay a significant price premium for the cholesterol-lowering margarine products. The challenge for public policies is to frame a regulatory and review system that is flexible enough to protect consumers from product risk and fraud, yet support new technologies and consumer interest in choice for technologies that offer health-promoting attributes in food products.

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Notes

1. We did not have access to advertising expenditure data by month. Excluding the advertising and other non-advertising effort from the estimated demand equation could potentially lead to biased estimates, and it is important to acknowledge this limitation.
2. Benecol was offered as both regular and diet types and thus some Benecol products have both the "cholesterol-lowering" attribute and the "diet" attribute.
3. Although the estimation (the price coefficients) is sensitive to the scaling of the predicted attribute values, we find the signs of the price coefficients are always consistent and significant.
4. The reference group is those adults that have completed a 4-year college degree or more. Since our data lack information on wage rates, the wage effect comes through the education variable, holding age constant. Higher education means higher opportunity cost of leisure.
5. Reference age group is adults less than 50 years of age.
6. In fact, when adjusted for quality, butter became a complement attribute. We used the Cox and Wohlgenant (1986) methodology for quality adjusting of unit values.

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